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ABSTRACT

This study focused on the problem-solving of family groups including an adolescent diabetic. The study sought to: compare three methods used to identify and analyze phases in family problem-solving interactions, establish criteria to evaluate the methods, utilize the criteria to evaluate the three methods, and select a method. The three methods were: R. Bales and F. Strodtbeck's method, the marker method, and the rating method. The Bales and Strodtbeck method divides a family's interactions into three equal phases; predicts the phase in which the frequency of a particular behavior would be highest, intermediate, or lowest; and compares the observed ordering of each behavior against the ideal predicted ordering. The marker method conceptualizes the problem-solving process as an eight-step loop which might be repeated several times. The rating method, also using an eight-step loop, goes on to assign points to particular problem-solving behaviors and then rates the family's effectiveness based on the number of points assigned. Using the three methods, nine well-functioning families were ranked as being high, moderate, or low in rationality. The relative rankings were consistent for the majority of the sample. It appeared that any of the techniques could be used for a project such as this. (JDD)

Arriving at a Method to Determine Phases in Family Problem Solving

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Introduction

Problem solving is a key function of family systems(Klein & Hill, 1979; Reiss, 1981; Watzlawick, Weakland & Fish, 1974; Montgomery, 1981; Turner, 1970 ; Haley, 1976). The entire family unit as well as smaller sub units within the family are continuously involved in resolving situations which comprise new or changed conditions that make old habitual responses inappropriate or ineffective. These situations are defined by problem solving researchers as problems. Using this definition, a whole range of daily family situations fit the definition. In common usage however the word problem, when associated with the family, has been limited to severe, crisis oriented situations. There is a growing body of theoretical and therapeutic literature which suggests that those family groups which are able to resolve the daily and routine, as well as the crisis oriented situations, which demand new or changed conditions function better than those who cannot.

Some of this evidence comes from the assumptions and experiences of therapists using the task centered therapeutic approach(Reid, 1985; Reid & Smith, 1981; Bell 1981; Reid & Epstein, 1972; Epstein & Bishop, 1981); other evidence comes from structural therapy (Minuchin, 1974; Minuchin & Fishman, 1981). While therapy focuses on "target" problems, these methods also address the family context and application of problem solving strategies to daily living. Work by Paolucci, Hall and Axinn (1977), Olson et al.(1983) and Metcoff and Whitaker (1982) and Cunningham and Saayman(1984) also support this view.

Even though problem solving is recognized theoretically as a key family activity, there is little empirical data which describes the process which family groups employ to resolve these situations. This dearth of information may be attributed to several factors: the difficulty and costliness of studying family groups as well as the limited number of methodological tools available to assist researchers in capturing on-going family interaction. The lack of even descriptive data about how families function as problem solving groups has prevented the validation and refinement of theories of problem solving effectiveness which could be employed in a whole range of family life interventions. This paper addresses this problem by comparing three methods used to identify and analyze phases in family problem solving interactions.

Nature of Research Problem

The present research focuses on the problem solving of family groups including an adolescent diabetic. Families with adolescents are at a stage of the life cycle which is filled with the normal, natural trouble of handling the significant developmental changes of the adolescent as well as those of other family members(Havighurst, 1956; Aldous, 1977; Hamburg, 1974; Olson, et al., 1983). The situations which represent the adolescent's attempt to achieve a greater level of independence from parents are common ones to most families. While the developmental situations may have some commonality for family groups at this stage, there is variability in the level of success that families achieve in resolving these situations. Olson, et al.(1983) suggest that"No other stage of the life cycle seems to be more stressful than the adolescent stage."

The presence of a chronic illness like diabetes in the life of the adolescent appears to complicate family life even more(Ahlfield, Soler, & Marcus, 1983; Bruhn, 1977; Cerreto & Travis, 1984; Hoette, 1983; Anderson, Miller, & Auslander, 1980) . Problem solving skill and success is particularly important for families which must deal with the developmental changes of adolescence as well as those associated with the ongoing day to day management of adolescent diabetes(Sargent, 1985; Swift, Seidman & Stein, 1967; Anderson, Miller & Auslander, 1980).

Once a researcher has decided to focus on problem solving interaction for a particular family group, a number of issues surface. The first of course relates to what aspect of problem solving interaction shall be addressed. Klein & Hill's(1979) conceptual model of family problem solving effectiveness demonstrates the complexity of the subject. The model is far too complex to be addressed in a single study. The Family and Diabetes project (Kieren & Hurlbut, 1985b), which is a two year project sponsored by the Social Sciences and Humanities Council of Canada, selected phasing and its relationship to family problem solving effectiveness as its focus for the study of family problem solving. The basic hypothesis is a rationality hypothesis; those families which demonstrate organized, patterned and sequential family problem solving interaction will achieve more effective problem solving as measured by different aspects of diabetic management.

Three person family groups are observed resolving three problem solving vignettes to obtain the measure of family problem solving.The study design is described in detail in another document and is not the focus of this paper.

Problem Solving and Problem Solving Effectiveness

The manner in which family members organize their behavior for problem solving comprise the variables which are proposed theoretically to have the greatest impact on family problem solving effectiveness. Every problem solving theory reviewed by Klein and Hill (1979) included problem solving interaction as a key factor. Problem solving interaction however can be analyzed in different ways. Klein and Hill proposed four principle axes for problem solving interaction analyses: frequency, distribution, sequencing and normativity. Our particular research emphasizes sequencing, which is the analysis of the manner in which family groups proceed from recognition of a problem through to evaluating the result. Klein and Hill(1979) coined the term" phasing rationality" to comprise the various steps or phases which have been used to describe the process. Phasing rationality is therefore defined as " the orderliness with which a family progresses through the problem solving process"(p. 522). They suggest that such a complex concept has the potential for many indicators(e.g. cooperation in arriving at a solution, sequence of phases without skips, repetition of phases, time spent in various phases compared to total time, partialization of problem parts). Unfortunately while the number of operationalizations abound, few instruments are available to measure these variables. While the study of phasing rationality appears to have promise to gain a greater understanding of family problem solving interaction, the measurement inadequacies must be addressed.

Empirical study of the phasing rationality concept for family groups is limited. In addition the evidence is inconclusive. Some researchers have demonstrated qualitatively different periods within problem solving or conflict sequences (Bales & Strodtbeck, 1951; Gottman, Markman, & Notarius, 1977; Raush, Barry , Hertel & Swain, 1974) whereas others (Aldous & Ganey,1982; Simmons, Klein & Thornton, 1973) report no evidence of a rational pattern. The methodological procedures to identify phases and test for rationality vary from study to study. In most cases, the techniques developed have been used by a single researcher or research team and have not been subjected to the kind of critical examination which more widespread use would afford.

The present paper addresses this methodological gap. It shall describe the work in progress to evaluate methods of identifying phases and to begin the dialogue necessary to arrive at methodologically sound techniques to test the phasing rationality hypotheses posed in the present Family and Diabetes Study. The specific objectives of the paper are:

1) to describe and demonstrate the use of three potential methods of identifying and testing phases in family problem solving interaction

2) to establish criteria to evaluate various methods of identifying phases in family problem solving interaction;

3)to utilize the criteria to evaluate the three methods of identifying phases and

4) to select a method which might utilize the benefits of this analysis and critique for the current study of family problem solving interaction and adolescent diabetic management.

Data from the pilot research (Kieren & Hurlbut, 1985 a) will be used for all analyses in this paper. This is comprised of data from 9 well functioning three person family groups. Each family resolved three problem solving vignettes. All interaction was videotaped.

Rationality and Family Problem Solving

Models of Problem Solving

Most models of individual problem solving are step wise models implying a phase oriented process. These models are best classified as "ideal" models since little empirical evidence has been provided to validate them empirically. Group problem solving and thus family problem solving have been assumed to follow a similar step wise or phase oriented process. Empirical validation is however even more limited for family problem solving than for individual problem solving. The study of phasing in family problem solving poses questions like the following:

Is there a pattern in the process used by family groups to resolve situations which fit the definition of a problem?
Is the pattern random or does it have rational characteristics?
Is it a general family pattern or does it vary depending upon situational factors (e.g. the characteristics of the problem, who is involved, the family stage of the life cycle and thus the developmental level of the participants)?
Is it a universal pattern, or does it vary by family?

Rationality and Problem Solving

Defining rationality continues to be a topic worthy of considerable discussion.There have been several views of how one might identify rationality in individual or group problem solving processes. The presence and character of phases is just one of these views.Brim, Glass, Lavin and Goodman(1962) reviewed various definitions of rationality and like Newell and Simon(1972) suggest that rationality cannot be defined or operationalized without reference to a set of conditions. One important condition is the type of decision which is of concern. One could classify decisions based upon formal properties (e.g. degree of risk involved, information available) or on different types of substantive elements(e.g. each class is analyzed by the activity involved, child rearing, political). Another condition is whether an insider or outsider shall do the evaluating, and still another is the nature of the criteria. These authors identify two major definitions of rationality, each differing in the criteria used to identify rationality. The first uses the characteristics of the results of the decision(e.g. success in satisfying desires, reaching expected solution) and the other which uses characteristics of the process as criteria for rationality(e.g. a process is more rational if it considers long range consequences, selecting alternatives which maximize expected utility etc.). The first definition assumes that the outcome will reflect prior decision making processes. How one arrives at the salient characteristics for the second definition may be quite different and may range from using proverbs, maxims, and common sense ideas of good thinking all the way to making comparisons of the observed process with ideal theoretical models. The present research utilizes the second definition in that rationality is assessed by comparing the observed process with characteristics of the ideal problem solving process.

While several researchers have been interested in testing the rationality hypothesis for family problem solving, not all have been interested in using criteria which assess phasing as we have previously described it. Brim et al.'s work(1962) on the evaluation and strategy phases of the decision process in child rearing decisions is one example. These researchers focused on ten characteristics of rationality which had been identified in the literature for these two phases and proceeded to test the expected utility maximization hypothesis. Using a paper and pencil test they found that subjects did tend to select among the child rearing alternatives as if to maximize their expected utilities.

Aldous and Ganey(1982) approached the test of rationality in a slightly different fashion. They focused on one phase of the process, problem definition. The question posed was, do families who are confronted with a series of potentially problematic situations engage in a problem definition phase before going on to solution strategies. In their study, the presence or absence of an identification phase was related to member's satisfaction with performance in the session. A tape recorded interaction of a three person family group discussing salient problems was used. No time limits were set for the discussion. The task for the family was to discuss the proposed situaion. Remarks were coded into three categories 1) solution perspective, 2) evaluation perspective and 3) analytical perspective. Gottman et al.'s (1977) sequential analysis of verbal behavioral processes was used to identify patterns. The indicator for problem definition behavior was: how often a person looked at other parts of the situation before going on to solution strategies. The proportion of each member's solution perspective statements preceded by evaluation or analytic code statements by self or others was an indicator of solution oriented sequences. A measure of structured verbal communication was also calculated. This was the ratio between patterned sequences of verbal behaviors and random sequences of comments and responses in families.

Aldous and Ganey tested the rationality hypothesis by testing a theoretical model which proposed that problem defining behavior would be related to family member's satisfaction with their performance in a session rather than assessing the relative proportion of problem defining behavior within the phase.

Katona and Mueller(1954) developed an index of deliberation about consumer decisions which could be considered a rating system to test the rationality hypothesis. In a rating system ,a set of judges arrive at a score or rating of a problem solving sequence based on a set of criteria. In the study by Simmons, Klein and Thornton (1973) a rating system was used by judges to rate an individual family member's perception of his or her own decision making process related to donating a kidney to a dying relative. The question posed was whether the individual perceived his choice process as "one of deliberation and rational weighing of alternatives followed by a clear decision or whether some other process seems to better fit his perceptions"(p. 89) Questionnaires, qualitative and focused interviews provided the data for the judges to rate. Two independent coders classified the decision making process of each donor and non donor according to three basic models of decision making: the rational model, the moral model and the postponement model. No details were provided on the specific criteria used by the judges but interjudge reliabilities were reported to be satisfactory. Results indicated that 68% of donors used the moral decision making model, 16% the rational model, 5% the postponement, and 3 % miscellaneous. Seven percent could not be rated. The evidence for non donors had a similar pattern although slightly more (25%) used the rational model.

Even though each of these different tests of rationality *could* have included criteria which focused on phasing, this was not the intent of their research. The following discussion reviews specific methods which have this focus.

Methods of Identifying Phases for Family Problem Solving

Given the application of step wise models of individual problem solving to family problem solving, the basic questions related to phasing which researchers have asked are: 1) do family groups follow a rational pattern when they are engaged in a process of problem solving, and 2) if so, how does this pattern relate to the generally accepted "ideal "model? The following section reviews methods of identifying phases for family problem solving. Recognizing that our list may not be exhaustive we challenge members of the workshop to add to our list.

Bales and Strodtbeck (1951) used the term phases to describe different sections of the problem solving process. They defined phases as "qualitatively different subperiods within a total continuous period of interaction in which a group proceeds from initiation to completion of a problem involving a group decison" (p. 485). The hypothesis they tested was: for groups fitting certain criteria (normal, adults, minimum pressure for solidarity, engaged in single complete cycle and a full fledged problem) three successive phases would occur 1) orientation, when problems are identified and begin to be resolved, 2) evaluation, when different courses of action are assessed, and finally, 3) control, when the group tries to achieve agreement and some kind of solution. However, the groups with which Bales and Strodtbeck dealt were not family groups.

The method Bales and Strodtbeck used to identify and test phases was a simple one. After recording interactions on tape, the total cycle of operations of the period to be analyzed was divided into three equal sections, a first, middle and third phase. Each phase included one third of the acts of the total. They suggested that this was approximately equal to a time division. The hypotheses tested related to predicting the phase in which the frequency of a particular behavior (e.g, evaluation) will be highest, intermediate or lowest when rank ordered. These hypotheses are based on frequencies of particular types of behavior across all phases. They argued that the rate of the selected behavior should be at its own high point in the one specified phase. The rationale for their hypotheses is based on the theories related to the mental processes involved in individual problem solving (e.g. speaking in evaluative terms implies previously accomplished orientation and attempts to control implies both orientation and evaluation).

Bales and Strodtbeck used data from 22 groups interacting on a variety of tasks. The interactions of the 22 cases were analyzed in terms of five types of behavior (orientation, evaluation, control, negative,and positive) based on the occurrence of maxima and minima of the behavior in the predicted phase. The hypothesis was tested by comparing the observed ordering of each type of behavior against the ideal predicted ordering.

They argued it is "inappropriate to consider the goodness of fit in terms of the number of instances in which the predicted values match the observed values" (p. 491). This is because it may be more serious if a predicted low is exchanged with a predicted high than a predicted high with a predicted median. For this reason they counted the number of transpositions of adjacent values that is required to establish the predicted order. For each behavior, this yields a minimum of no transpositions (perfect fit) to three transpositions. For the five behaviors combined this gives a range of zero to 15 transpositions possible per family. Using an adaptation of Kendall's rank correlation coefficient *tau* three or fewer transpositions were determined to be necessary to reject the null hypothesis of random distribution at the .05 level. Six of the eight sessions fulfilling the established problem criteria required 3 or fewer transpositions. None of the 14 sessions which did not fulfil the criteria were significantly different from a random pattern. A chi square test was utilized to make a single test of the significance of the aggregate. Bales and Strodtbeck's data using 22 cases rejected the null hypothesis that the distribution of phase sequences was random. Since 14 of the 22 cases did not fully meet their specified conditions, another chi square was calculated to partition the chi square values of the aggregate. Results indicated that cases which meet Bales and Strodtbeck's criteria do deviate significantly from random expectations and that cases which do not meet conditions do not deviate significantly. The specifications of external problem conditions appear to be very important to make accurate predictions.

Bales and Strodtbeck stated that their findings were in fact paradoxical. The 14 cases which were not full fledged problems failed individually to fit the phase hypothesis yet when added to the aggregate with 8 other full fledged problems they did conform as predicted. Bales and Strodtbeck speculated that there may be compensating differences in this set of cases, or certain conditions may operate which may be similar from case to case regardless of specific differences (p. 493). Parts of the process of problem solving interaction naturally affect other parts. Thus there are internal conditions which happen regardless of the specified external conditions which they specified in their hypothesis.

Gottman et al.(1977) used a similar technique to that of Bales and Strodtbeck for the identification of phases in the marital conflict sequence. Each marital conflict sequence was divided into beginning, middle and end by thought units. The research question was: What are the major activities which occurred in each hypothesized phase and the major differences between clinic and non clinic couples in the maneuvers in which they engaged during conflict resolution? Using a sequential analysis program, they identified patterns within each phase (agenda building, arguing and negotiation).

The work by Raush, Barry, Hertel and Swain(1974) also used the term phases to describe different portions of a conflict resolution process. While they also hypothesized three phases, the phases were demarcated by "marker" behaviors. These are specific behaviors from the ideal model which are used to demarcate the beginning and end of a hypothesized phase. The <u>introductory phase</u> included all acts prior to the introduction of the conflict issue, <u>the conflict phase</u> included acts that began with the first statement of the conflict issue and continued until the introduction of an agreed upon resolution. <u>Resolution and post resolution</u> began with an act attempting achievement of a resolution and including the subsequent discussion. The identification of the conflict marks the end of the introductory phase and the beginning of the conflict phase. The researchers were interested in examining "how couples differed in their approach to the uncertainties induced by conflict including their acceptance or rejection of a probabilistic orientation" (p.17). Deutsch's work (1969a &b) provided the basis for their phasing hypotheses.

The marker method of identifying phases was first used in the pilot research(Kieren & Hurlbut, 1985a) for the current Family and Diabetes Study (Kieren &Hurlbut, 1985b) and has been revised in the interim (Kieren & Hurlbut, 1987). It was based on a conceptualization of the problem solving process as an eight step loop(identification of the problem, restatement or formulation of the goal, assessment of resources, generation of alternatives, assessment of alternatives, action, evaluation of action and problem solving process) which might be employed with several complete or incomplete repetitions over a problem solving sequence (see Figure 1). Such repetitions allow families to rework or clarify decisions even when a decision may have been arrived at.

Once family interaction was coded using a 26 category code(Kieren, 1985- See Figure 2), the four phases were operationalized as follows:

Phase I Introduction began with the beginning of the discussion and ended at the code immediately preceding the first proposed alternative code.

Phase II Generation & Assessment of Alternatives began with the first proposed alternative code and ended at the code immediately preceding a resolution code.

Phase III Resolution began with the first code that represented a resolution code and ended at the code immediately preceding a decision code.

Phase IV Decision began and ended with the first decision code or consecutive decision codes and a new loop began as soon as another behavioral code appeared.

After coding the data, the 26 category coded behaviors were grouped into four problem solving summary categories (identification, exploration of alternatives, resolution mechanisms, and decision processes) and three no problem solving summary categories. The behaviors grouped into each summary category are shown in Figure 2.

The basic phasing hypothesis tested in the pilot research was that:

Problem solving patterns in well functioning families will be predictable and rational as evidenced by two criteria: (a) highest proportion of the phase specific behavior for the predicted phase when compared to other types of behaviors within the phase(<u>within</u> phase comparison), and (b) highest proporition of phase specific behavior for the predicted phase compared with the same type of behaviors in other phases (<u>across</u> phase comparison). For example, the specific hypotheses tested for phase one were:

a) identification behaviors will constitute the largest proportion of all behaviors in phase 1(within phase comparisons).

b) identification behaviors would constitute the largest proportion of behaviors for phase 1 compared with identification behaviors in phases 2, 3, 4 (across phase comparisons).

Four omnibus tests (Dunn, 1961) were used to test the proportions in pairwise comparisons.

Another method which could be used to identify and test phases is a rating method. While several researchers have suggested this method the techniques have not been described in the literature. The following method was developed for this paper. As with the Marker method, this rating method was based on the conceptualization of Kieren, Vaines, and Badir (1984), that the problem solving process consists of eight steps with complete or incomplete repetitions over an entire problem solving situation (See Figure 1). Once the family interaction was coded, using the 26 category codes , the problem solving loops in a total problem solving sequence were determined by the following criteria. Loop one began at the beginning of the family interaction, and was completed once the following occurred:

1. Any identification behavior.
2. Followed by at least one proposed alternative code.
3. Followed by behavior that explores an alternative.
4. Followed by resolution mechanism behavior.
5. Followed by a decision behavior, or a decision and decision evaluation behavior.

This ended the first loop. If any of the above categories of behaviors were missing, the data was analyzed as if it were one loop. The second loop and all subsequent loops could begin with an identification code, an alternative code, an evaluation of an alternative code, or a resolution mechanism code, whichever code was the first to appear after the end of the previous loop. If one loop began with an identification code,the loop proceeded the same as loop one. If it began with an alternative code, it would proceed to the next behavior on the above sequence and so forth as in loop one. This same sequence was required no matter where the loop began.

The problem solving loops could be incomplete. All loops could end at any behavior without completing the sequence and all loops, except loop one, could begin at any behavior except the decision and decision evaluation behaviors. The basic hypothesis tested was that: Problem solving interaction in the sample of nine well functioning families will be non random as evidenced by a rationality score that is higher than would be expected by chance alone.

The rating score was made up of 29 points per loop. The assumption was that the higher the score, the more rational the family's problem solving behavior. Thus the score could be used as an index of rationality. Six criteria determined how the points were allocated. First, the family got one point for the presence of certain problem solving behaviors. They received a point for one or more examples of an identification behavior, one point for a goal behavior, one point for an alternative, one point for exploring the alternative, one point for a resolution mechanism behavior, one point for a decision behavior, and one point for a decision evaluation behavior. As such, the family got seven of their 29 "rationality demonstrating points" for using the predicted problem solving behaviors at least once.

The second assumption was that problem solving behavior is more rational when families consider more than one alternative to solving the problem. This resulted in the families receiving one point for suggesting two or more alternatives anywhere in the sequence.

The third assumption, based on our theoretical model that problem solving consists of steps, was that the behaviors were more rational if they occurred in a certain order. This resulted in the families receiving one point for each behavior that occurred in the predicted order. For instance, the family received one point when an identification occurred before a goal was set, and another point when an identification occurred before an alternative was proposed and so forth until the family received a maximum of six points for the ordering of identification behaviors. The second behavior predicted in the ideal model was the goal. The families received one point for the goal occurring before the alternative, one point for the goal occurring before exploring the alternative and so forth to a maximum of five points. The remaining orderings were calculated in a similar fashion with a maximum of four points for the alternative behavior, three points for the exploration of alternative behavior, two points for the resolution mechanism behavior, and one point for the decision behavior. This accounts for 21 of the 29 possible points.

The other criteria for the rating method were based upon the determination of the order of behaviors in the loops. All categories of behaviors were used to rate a loop except the goal setting behaviors. Goal setting was not included since goals occurred too infrequently (a total of three goals were coded for the first loop of all 27 vignettes). Also, the rating was calculated separately for each loop for each vignette for each family. This meant that the number of loops could vary between vignettes and families. There was a mean range of one to five loops per family. Only loop one had to begin with the predicted first behavior. In order to reduce noise, and to compare with the data analyzed with the Bales and Strodtbeck method in the data base, only loop one was analyzed for this paper. In summary, the rating score consisted of a maximum of 29 points per loop and a minimum of zero.

The test of the phasing hypothesis is relatively complex for this method. A stochastic process is necessary to determine whether the rating data differs significantly from chance, or the ideal model. This analysis will not be a part of this paper but will be discussed in a subsequent paper(Hurlbut & Kieren, 1987).

It is also possible to utilize a technique which would be based upon an analysis of the flow of interaction of a particular family. This could involve content analysis of the coded interaction units or the use of a stochastic process to identify the family's own unique step wise process. We are calling this a typology method in that the family's unique interaction pattern would be detailed by describing it rather than comparing it with an ideal model. For example, considering four summary categories (R1=Identification, R2= Alternatives ,R3=Resolution, and R4=Decision) it is possible for a family to have a whole range of different patterns: R4,R1,R3,R4; R2,R3,R4; or R2, R1,R3,R4. The hypotheses tested would involve a test of whether the family's pattern of problem solving varies across situations, how the patterns vary across families, and how a family's unique pattern relates to other problem solving variables. The literature does not report any studies using this method and it was deemed beyond the time limits of this paper to develop it.

Establishing criteria for Selecting a Phasing Method

The previous review of potential methods which may be used to identify and test a phasing rationality hypothesis provides the background for an assessment of these procedures as suitable methods for the Family and Diabetes Project. Such a selection implies that there are criteria for the selection of a method which would assure the researchers that the method is methodologically sound. The critical issues which must be addressed by such a method are: 1) is the method congruent with the theory of problem solving employed in the research, 2) will it accomplish the research objectives economically, 3) is it free of bias toward rationality, 4) will it provide an index of rationality, 5) is the method a valid method as assessed by whether similar results are obtained using different methodologies?
Using these criteria, three of the previously described methods were conceptually and empirically tested using the interaction data obtained from the previous pilot study of 9 well functioning families. The methods chosen were1) Bales and Strodtbeck, 2)the marker method utilized in the pilot study by Kieren and Hurlbut, and3) the rating method which has been developed by the authors. The methods were selected to build upon the pilot work and to provide sufficient contrast to the marker method .Each of these methods are sufficiently different in their approach and thus were believed to represent a broad examination of possible avenues for measurement of this dynamic variable.

Bales and Strodtbeck's (B&S) Method: A Critique

Fit with Theory

The conceptual theory proposed by Kieren and Hurlbut differs in some ways from that proposed by Bales and Strodtbeck. K & H view the problem solving process of a single problem solving situation as potentially including several complete or incomplete loops of the problem solving sequence. B & S, by dividing up the problem solving sequence into three equal parts and analyzing the data in this fashion, assume that individuals and groups go through the sequence only once. In order to use B & S's method and be most compatible with our conceptualization of problem solving the empirical test with the K & H pilot data should only include data from the first identified problem solving loop. Since this loses a great deal of data two tests were run, one with the first problem solving loop and the other with all loops.

Answers Research Questions Economically

The method can answer the research questions posed in the Family and Diabetes Project in an economical fashion. The analyses required are relatively easy to accomplish.

Free of Bias Toward Rationality

The method does not appear to build in biases toward rationality. While three phases are hypothesized , the characteristics of the behaviors within these periods must provide the evidence. The use of transpositions rather than magnitude builds in some degree of rigor since it requires that a specified sequence of frequencies of behaviors is necessary to fully test the model. The test however limits itself to a test across phases and does not include a test within the phase.

Index of Rationality

The current research requires some index which could be used to test the research hypothesis that those families which are more organized and systematic in problem solving will be more effective problem solvers as measured by diabetic management indicators. The B & S technique has the possibility of arriving at a score reflecting the degree of rationality for each family. The indicator which could be used for this purpose is the total number of transpositions each family required. The lower the score the more closely the family compared with the predictions. Used in this way an interval measure or index of rationality could be assigned. The number of transpositions per family ranged between two to nine for loop one and three to six when all the data was analyzed. All ties were scored against the predicted theory.

Empirical Test

The K & H pilot data were utilized in two empirical tests. In the first test, the data from loop one only was analyzed; in the second, the data from all loops was analyzed. Each time the data segment was divided into three equal portions by coding units. The predictions which were made for the various phases are reported in Table 1.

The probability for four three item rows was calculated using the coefficients of the expansion of the formula $(1 + 2x+2x^2 + 1x^3)^k$. In this case k=4. From this table it was determined that if there are two or fewer transpositions, the null hypothesis of randomness would be rejected at the .05(p=.032) level. In the analysis of all loops, none of the individual tests for each family was significant. In the analysis of loop one, only one test was significant. Neither chi square test of the aggregate for nine families across all loops nor for loop one was significant (x=22.19 and x=21.32 respectively with 18 degrees of freedom).

The empirical test of B & S's model using pilot data in two ways indicated that one cannot reject the hypothesis of random distribution. The cases under consideration do not deviate significantly from random expectations. The phasing rationally hypothesis does not receive support.

The Marker Method: A Critique

Fit With Theory

The marker method has a close fit with the conceptual model since it was developed with that model in mind. The problem solving sequence is conceptualized as being comprised of several repetitions of the problem solving loop. An ideal sequence is predicted which is very similar to other problem solving models.

Tests Research Questions Economically

The major data summary is a proportional analysis and four sets of planned comparisons of these proportions. Various computer programs can be adapted to arrive at the analyses of the proportions of each behavior in each phase.

No Bias Toward Rationality

This technique limits the variability in the summary of the data more than the B&S technique since the identification of phases are markers which are components of the ideal model(e.g., no alternatives cna occur in the identification phase). However, because the criteria established to test the characteristics of the identified phases are rather rigorous there is only minimal bias toward obtaining rational rather than random results. Hypotheses related to phase specific behavior both <u>within</u> and <u>across</u> the phases are tested.

Index of Rationality

Two different indices are possible. For the first index, the differences between each of the 12 pairs of percents of problem solving behaviors (see Table 2) used in the analysis can be compared to a confidence interval. In this case we have established a confidence region of 10% greater in order for the differences to support the concept of rationality. The number of differences greater than 10% may be used as a family index of rationality. This index was used in the analysis in this paper.

A second index could be calculated by summing the differences of the 12 pairs of percents. In this method, the contrasts that do not support the rationality hypothesis would have a negative sign and thus be subtracted from those that do.

Empirical Test

All the problem solving data was utilized to test the hypotheses. The twelve pairwise comparisons were analyzed by four tests using the procedure for planned multiple comparisons in sample proportions for multiple independent samples (Marascuilo & McSweeney, 1977). This was done for all families combined. The major problem with this analysis is that the proportions in our data are not statistically independent and this is an assumption of the statistical test. This makes our results somewhat unreliable.We have not yet found an appropriate procedure for multiple comparisons of correlated proportions. Table 2 reports the proportions. The results indicate that eight of the twelve comparisons were significant at the .01 level using Dunn's table for multiple comparisons (see Table 3).

The within phase comparisons indicate fai ; strong support of the rationality hypothesis. Five of the six within phase pairwise comparisons were significant at the .01 level. The sixth was significant at the .05 level. The test of the hypotheses with across phase comparisons yielded mixed results. The predicted hypotheses for the identification and exploration of alternative summary categories were rejected whereas the ones for resolution mechanisms and decision processes were not

The Rating Method: A Critique

Fit with Theory

This method also fits the theory proposed for the research by Kieren and Hurlbut. The rating method has been specifically designed to allow for analysis of a single loop or all loops in a session. The behaviors rated were those identified by the theory as comprising key problem solving behaviors. Since theory would support the view that proposing more than one alternative contributes to problem solving effectiveness a rating item was also provided for multiple alternatives. The rating system builds in both presence of specific problem solving behaviors and sequence.

Tests Research Questions Economically

Use of the rating method is relatively easy to use. No major difficulties were experienced by raters in arriving at a score.

No Bias Toward Rationality

The rating scale is based on characteristics of a rational model of problem solving however it is a rigorous test employing both presence and sequence of behaviors.

Index of Rationality

The score arrived at in the ratings could ideally range from 0 to 29 per loop;the higher the number the more rational the problem solving pattern. Each loop was rated individually. The score arrived at by this method could in fact be used as an index of rationality. The scoring may also allow for sub scores of different parts of the process. This may have an advantage over the other two methods discussed.

Empirical Test

Families were rated on loop one and all completed loops separately. Results on loop one indicated scores that ranged from 13 to 25. In order to determine whether the rating of an individual family differed from that which would occur by chance a stocastic process is necessary. Accomplishing the programming to run this test was beyond the time limits for the present paper but will be discussed in a subsequent paper.

Comparison of the Results of the Three Methods

Two empirical tests (B & S and rating) were computed on similar data (loop one). The marker method was computed on all loops. Table 4 reports the results.

Looking at the relative rankings each family would receive and whether the family would be similarly categorized as high (Ratings 1,2,3), moderate (Ratings 4,5,6) or low (Ratings 7,8,9) in rationality it appears that all three methods identified family # 1 as the most rational. All three methods rated family 5 in the lowest and family 7 in the moderate category. Two methods rated family 2 in the lowest and families 6 and 8 in the highest category. Two methods rated family 3 in the mid range. The largest differences in ratings were for families 4 and 9 which were categorized differently by each method. Thus the relative rankings using three different methods were consistent for the majority of this sample of well functioning families.

Selection of a Method for the Family and Diabetes Project

The comparison and critique of the three phasing methods does not reveal an easy answer to this problem. It would appear that any of these techniques could be used for this project even though the statistical procedures used for the rating method are at this time just being worked out.

Summary

The development of methodological procedures for problem solving research will be a key element in the continued progress in the field. To date, researchers have been more interested in testing hypotheses rather than developing methodologies. Funding agencies are also often more interested in obtaining answers to perplexing human relations problems rather than in how to measure and test these dynamic concepts. The analyses involved in using these three methodologies indicate that other statistical methods may need to be identified which do not assume independence between various variables. Another question is how much bias is built into any phasing method which is based upon an ideal model of any kind. Continued discussion and further collaboration between interaction researchers will undoubtedly assist in answering these questions.

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Tables

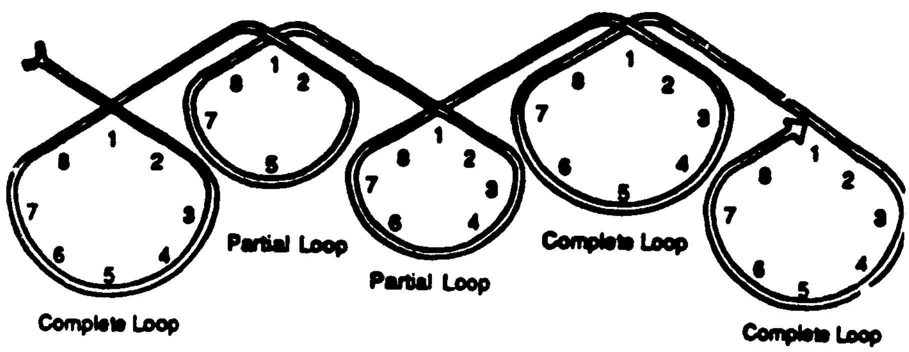

Figure 1: Individual Problem Solving

Table 1

Expected Phase in Which Frequencies of Acts by Type will be High, In each Category

Category of Act	High	Intermediate
Identification	1	2
Alternatives	2	3
Resolution	2	3
Decisions	3	2

Table 2

Proportions of Problem Solving Behavior
by Total, Row, Column
Across Families, Vignettes, and Loops

Summary Category	Problem Solving Phase I	II	III	IV	TOTAL
Identifies Problem	A	B	C		
FREQUENCY	61	71	73	0	205
TOTAL PCT	7.04	8.20	8.43	0.00	23.67
ROW PCT	29.76	34.63	35.61	0.00	
COL PCT	66.30	24.40	17.76	0.00	
Explores Alternatives		F	G		
FREQUENCY	0	183	152	0	335
TOTAL PCT	0.00	21.13	17.55	0.00	38.68
ROW PCT	0.00	54.63	45.37	0.00	
COL PCT	0.00	62.89	36.98	0.00	
Resolution Mechanism	I		K		
FREQUENCY	10	0	186	0	196
TOTAL PCT	1.15	0.00	21.48	0.00	22.63
ROW PCT	5.10	0.00	94.90	0.00	
COL PCT	10.87	0.00	45.26	0.00	
Decision Process	M	N		P	
FREQUENCY	21	37	0	72	130
TOTAL PCT	2.42	4.27	0.00	8.31	15.01
ROW PCT	16.15	28.46	0.00	55.38	
COL PCT	22.83	12.71	0.00	100.00	

Table 3
Pairwise Comparisons

Test 1: Identification	x^2	SE^2
A=B[1]	1.00	.0024
A=C	1.42	.0024
A=I	56.89*	.0054
A=M	35.00*	.0054
Test 2:Exploration of Alternatives		
F=B	87.12*	.0017
F=N	148.12*	.0017
F=G	1.72	.0015
Test 3: Resolution Mechanisms		
K=I	310.15*	.0026
K=C	63.00*	.0012
K=G	7.17**	.0012
Test 4:Decision Process		
P=M	40.5*	.0038
P=N	19.08*	.0038

[1] The letters refer to cells in Table 2
*significant at the .01 level or less
**significant at the .05 level or less

Table 4
Comparisons of Results of Three Methods

Family	B & S_1	Rank	HML	Marker$_2$	Rank	HML	Rating$_3$	Rank	HML
001	* 2	1	H	12	1	H	20	1	H
002	ns 7	8	L	8	5	M	16	7	L
003	ns 5	4	M	11	2	H	18	4	M
004	ns 4	3	H	8	5	M	15.7	9	L
005	ns 6	7	L	7	8	L	16	7	L
006	ns 9	9	L	9	3	H	19.3	2	H
007	ns 5	4	M	8	5	M	17	6	M
008	ns 3	2	H	9	3	H	18	4	M
009	ns 5	4	M	6	9	L	19	3	H

1This equals the number of transpositions Range of 0 to 12, the higher the less support for the ideal model.

2The marker figure is the number of pairwise comparisons where the proportions were 10% greater in the predicted direction. Range of 0 to 12, the higher the greater the support for the ideal model.

3The rating score ranges from 0 to 20, the higher the score the more support

Figure 2
Coding Categories and Summary Codes

Sum Code	Code Numbers	Summary Codes
F	00-Fragment	**Problem Solving**
I	01-Identifies problem	I=Identification
I	02-Establishes a goal	A=Alternatives
A	03-Proposes an alternative	R=Resolution
A	04-Explores consequences	D=Decision
A	05-+Evaluates a specific alternative	
A	06--Evaluates a specific alternative	
R	07-Cognitive reasons for alternative	
R	08-Compromise	**Non Problem Solving**
R	09-Fairness	F=Fragment
R	10-Coaxing	In=Information
R	11-Power	P=Personal,emotional
R	12-Commanding	
D	13-Decision	
D	14- Evaluates solution and process	
I	15-+Evaluation of potential ability	
I	16--Evaluation of potential ability	
I	17-Assesses problem	
F	18-Meta problem solving	
In	19-Clarifies, summarizes, restates	
In	20-Information	
In	21-Questions	
In	22-Answers	
P	23-Agreement	
P	24-Disagreement	
P	25-Sarcasm/Humor	